

# PATENT SPECIFICATION

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## DRAWINGS ATTACHED

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## (54) METHODS OF MAKING BRANCH CONNECTIONS WITH FIBRE-REINFORCED COMPOSITE PLASTICS TUBES

(71) We, WAVIN N.V. a Netherlands limited liability company, of Zwolle, The Netherlands, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:

The invention relates to methods of making branch connections with composite fibre-reinforced plastics tubes.

Methods of making branch connections with plastics tubes such as polyvinyl chloride tubes are known, but in practice they cannot be applied to the generally used glass fibre-reinforced polyester tubes, especially those with a polyvinyl chloride inner tube. This is to be attributed to the fact that the glass fibre-reinforced resin layer can be less easily operated on than polyvinyl chloride.

It is an object of the invention to provide a method whereby in a simple way such composite glass fibre-reinforced plastics tubes can be provided with a branch connection whilst obtaining a sealing connection.

The method according to the invention comprises the following steps;

A— the perforation of the tube with suitable drilling means in order to obtain a branch aperture;

B— the introduction into the aperture of a sealing member made of a hard elastic material having inner and outer surfaces and having greater inner and outer diameters at the outer end thereof and smaller inner and outer diameters at the inner end thereof and formed with a radially outwardly bent over edge at least at its end of smaller diameter, the outer diameter of the sealing member at the inner end being at most equal to the diameter of the drilled aperture;

C— the expansion of the sealing member by the introduction thereof of a branch tube part of a hard material from the outer end of the sealing member with the greater inner diameter, the arrangement being such that the wall of the sealing member at the location of the greater inner diameter is pressed against the wall of the branch aperture and the bent over edge of the end of the sealing member of smaller diameter is pressed on the inner surface of the drilled tube.

Preferably the branch tube part is provided with an external screw thread and is screwed into the sealing member.

The sealing member is advantageously provided with two bent over end edges which cooperate with the inner and the outer wall of the composite tube on expansion of the sealing member.

A specially advantageous way of obtaining a sealing connection consists in that after the perforation of the tube as defined under A alone, the walls of the branch aperture are covered with glue and/or with a sleeve, corresponding to the diameter of the branch aperture, of a very elastic sealing material as a supplementary sealing means.

The invention also includes a sealing member suitable for use in the aforesaid method of making a branch connection with a composite fibre-reinforced plastics tube, the sealing member being formed of hard but elastic material ends and inner and outer surfaces and having greater inner and outer diameters at one end thereof and smaller inner and outer diameters at the other end thereof and having a radially outwardly bent over edge at least at the end of smaller diameter, the sealing member being adapted to be inserted in an appropriately dimensioned aperture of a wall of the tube with the bent over edge at the end of the sealing member of smaller diameter at an end of

the aperture and to be expanded by internal pressure exerted by a branch tube introduced into the bore of the sealing member from its end of greater diameter, whereby the outer surface of the sealing member at the location of greater diameter is pressed against the wall of the aperture and the bent over edge at the end of the sealing member of smaller diameter is pressed on the inner surface of the wall.

The invention furthermore includes a branch connection of a composite fibre-reinforced plastics tube wherein a sealing member of hard elastic material is provided between a branch tube and the surface of an aperture in the wall of the composite tube and wherein at least at the inner surface of the composite tube a radially outwardly bent over end edge of the sealing member is pressed against the inner surface of the wall of the composite tube.

The invention will now be clarified with reference to the drawing in which an embodiment is represented, various advantageously to be applied details of the invention being revealed in the course of the description.

In the drawings:

Figure 1 is a section through a part of drilled tube with inserted sealing member and partially introduced branch tube part to an enlarged scale; and

Figure 2 shows the same parts as in figure 1 but the branch tube part being screwed in the sealing member.

Represented in figure 1 is a tube consisting of a polyvinyl chloride tube 1, a fibre-reinforced polyester layer 2, a foam plastics layer 3 and a fibre-reinforced polyester layer 4. In this composite tube is drilled a hole 5 with a periphery 6. Provided on this peripheral wall 6 is a glue layer or a soft rubber sleeve 7. Thereupon a conical hollow sealing member 8 is introduced into the hole 5. This sealing member is provided with a bent over upper edge 9 and a bent over lower edge 10. The sealing member 8 consists of a hard elastic material having, however, such properties that the wall 11 of the sealing member 8 can be pressed outwardly. After the provision of the sealing member 8 a hard polyvinyl chloride branch tube part 12 provided with screw thread 16 on its outer side is screwed into the sealing member 8. The inner diameter 13 of the sealing member 8 corresponds with the outer diameter of the hard polyvinyl chloride branch tube part 12.

Due to the screwing in of the branch part 12 the wall 11 of the member 8 is pressed outwardly whereby the bent over edges 9 and 10 are pressed on the inner wall 14 and outer wall 15 respectively of the tube 1. Hereby a sealing connection between the tube 1 and the sealing member 8 is ob-

tained which is improved by the glue layer or soft rubber sleeve 7. It is advisable to provide the sealing member 8 with inner screw thread in order to facilitate the screwing in of tube parts.

The sealing member 8 has greater inner and outer diameters at the outer end and smaller inner and outer diameters at the other end. The smaller outer diameter at the inner end is at most equal to the diameter of the drilled aperture in the composite tube wall. The edge 9 could be omitted.

#### WHAT WE CLAIM IS:

1. A method of making a branch connection with a composite fibre-reinforced plastics tube, comprising the following steps:

A— the perforation of the tube with suitable drilling means in order to obtain a branch aperture;

B— the introduction into the aperture of a sealing member made of a hard elastic material having inner and outer surfaces and having greater inner and outer diameters at the outer end thereof and smaller inner and outer diameters at the inner end thereof and formed with a radially outwardly bent over edge at least at its end of smaller diameter, the outer diameter of the sealing member at the inner end being at most equal to the diameter of the drilled aperture;

C— the expansion of the sealing member by the introduction thereto of a branch tube part of a hard material from the outer end of the sealing member with the greater inner diameter, the arrangement being such that the wall of the sealing member at the location of the greater inner diameter is pressed against the wall of the branch aperture and the bent over edge of the end of the sealing member of smaller diameter is pressed on the inner surface of the drilled tube.

2. A method as claimed in claim 1, in which the sealing member inner and outer surfaces taper in conical fashion.

3. A method according to claim 1 or claim 2, wherein the branch tube part is provided with an external screw thread and is screwed into the sealing member.

4. A method according to any preceding claim, wherein after the perforation of the tube as defined under A in claim 1, the walls of the branch aperture are covered